UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION III
1650 Arch Street
Philadelphia, Pennsylvania 19103-2029

Mr. Larry Lawson, Director
Division of Water Program Coordination
Virginia Department of Environmental Quality
629 Main Street
Richmond, VA 23219

Dear Mr. Lawson:

The Environmental Protection Agency (EPA) Region III would like to amend its approval of the Polychlorinated Biphenyls (PCBs) Total Maximum Daily Load (TMDL) for the Shenandoah River to include South Fork of the Shenandoah River segments VAV-B55R, VAV-B57R, and VAV-B58R. Our original approval was for segments VAV-B41R and VAV-B51R which covered portions of the North Fork, South Fork, and mainstem of the Shenandoah River. However, the TMDL was developed to account for PCB loading to all five segments. Therefore, the TMDL approval should have addressed the same five segments. A copy of EPA's decision rationale was sent to the Commonwealth with the original approval.

In accordance with Federal regulations at 40 CFR §130.7, a TMDL must comply with the following requirements: (1) designed to attain and maintain the applicable water quality standards, (2) include a total allowable loading and as appropriate, wasteload allocations (WLAs) for point sources and load allocations for nonpoint sources, (3) consider the impacts of background pollutant contributions, (4) take critical stream conditions into account (the conditions when water quality is most likely to be violated), (5) consider seasonal variations,
(6) include a margin of safety (which accounts for uncertainties in the relationship between pollutant loads and instream water quality), (7) consider reasonable assurance that the TMDL can be met, and (8) be subject to public participation. The TMDLs for the South Fork, North Fork, and mainstem of the Shenandoah River, address all of the requirements listed above.

Following the approval of these TMDLs, Virginia shall incorporate the TMDLs into the Water Quality Management Plan pursuant to 40 CFR § 130.7(d)(2). As you know, all new or revised National Pollutant Discharge Elimination System permits must be consistent with the TMDL WLA pursuant to 40 CFR §122.44 (d)(1)(vii)(B). Please submit all such permits to EPA for review as per EPA's letter dated October 1, 1998.

If you have any questions or comments concerning this letter, please don't hesitate to contact Mr. Thomas Henry at (215) 814-5752.

Sincerely,

Jon M. Capacasa, Acting Director
Water Protection Division

Decision Rationale
Total Maximum Daily Load of
Polychlorinated Biphenyls (PCBs)
for the Shenandoah River, Virginia and West Virginia

I. Introduction

The Clean Water Act (CWA) requires a Total Maximum Daily Load (TMDL) be developed for those water bodies identified as impaired by the state where technology-based and other controls did not provide for attainment of water quality standards. A TMDL is a determination of the amount of a pollutant from point, nonpoint, and natural background sources, including a margin of safety, that may be discharged to a water quality-limited water body.

This document will set forth the Environmental Protection Agency's (EPA) rationale for establishing the Total Maximum Daily Load (TMDL) of PCBs for the Shenandoah River. EPA's rationale is based on the determination that the TMDL meets the following 8 regulatory conditions pursuant to 40 CFR §130.

1) The TMDL is designed to implement applicable water quality standards.
2) The TMDL includes a total allowable load as well as individual waste load allocations and load allocations.
3) The TMDL considers the impacts of background pollutant contributions.
4) The TMDL considers critical environmental conditions.
5) The TMDL considers seasonal environmental variations.
6) The TMDL includes a margin of safety.
7) The TMDL has been subject to public participation.
8) There is reasonable assurance that the TMDL can be met.

II. Background

The Shenandoah River drains 1,957,690 acres of land. The watershed can be broken down into several land-uses. Forest and agricultural lands make-up roughly 1,800,000 acres of watershed. The maximum elevation within the watershed is 3,350 feet mean sea level. The minimum elevation is 300 feet mean sea level and occurs at the confluence with the Potomac River. The Shenandoah River basin is composed of three subbasins (8-digit United States Geologic Survey (USGS) Hydrologic Unit Codes (HUC)). The three subbasins are the South Fork of the Shenandoah River (HUC 02070005), North Fork of the Shenandoah River (HUC 02070006), and the Shenandoah River (HUC 02070007).

The Shenandoah River was listed on both Virginia's and West Virginia's 1998 Section 303(d) lists. Fish consumption advisories (for PCBs) were the cause of listing in both States. The river is listed

for other impairments as well. Two segments of the Shenandoah River measuring approximately 42 stream miles in length were listed on Virginia's Section 303(d) list. The first segment, the North Fork of the Shenandoah River running from Passage Creek to its confluence with the South Fork of the Shenandoah River, measures 5.33 miles in length. The second segment, composed of the South Fork of the Shenandoah River and the Main Stem of the Shenandoah River, measures 36.45 miles in length. A third segment of the Shenandoah River was listed on West Virginia's 1998 Section 303 (d) list. The West Virginia segment measures 19.45 miles in length and runs from the VA State Line to the Shenandoah's confluence with the Potomac River.

PCBs consist of 209 chemical compounds (congeners) that were sold under various trade names. Aroclor is one of the many trade names under which these compounds were sold. PCBs exhibit excellent dielectric and heat resistant properties. These properties contributed to their widespread use in hydraulic fluids, flame retardants, and heat transfer fluids. These same properties also cause PCBs to accumulate in the fatty tissue of biota. PCBs are considered highly toxic and are classified as probable human carcinogens. The production and use of PCBs in the United States was outlawed in the 1970s.

In 1989, Virginia issued a "do not eat" advisory for all species of fish in the Shenandoah River and portions of the North and South Forks of the Shenandoah. The advisory was in response to sampling data collected by EPA that showed PCB concentrations as high as 92 mg/kg in fish tissue. West Virginia issued an advisory shortly thereafter (September 1989). For additional information on the Section 303 (d) listing, please see Section 1-4 of the *Shenandoah River PCB TMDL*.

A plug-flow model was used to determine the PCB loading to the Shenandoah River. The plug-flow model segmented the river into a series of reactors, in order to simulate the distribution of PCBs. Each plug-flow reactor defines a mass balance for PCBs distributed between the sediment and water column. The PCB load is then transferred from one reactor to another, eventually transferring PCBs from the USGS gage to the Millville Dam. The loadings were based on a sampling event held in April of 2001. Sediment was modeled as a source of PCB contamination to the water column. Sediment was also transported to the Millville Dam where it was subject to burial. The point source (Avtex) was modeled as discharging PCBs at its observed concentration at a flow rate based on its year 2000 annual flow. A background loading equal to the PCB concentration detected at the USGS gage was applied to the model. Please see section 5.0 for additional information on the modeling.

Table 1 below summarizes the specific elements of the TMDL.

Table 1, Summary of PCB TMDL (g/yr)

Parameter	TMDL	WLA	LA	MOS[1]
Total PCBs	214.7	179.38	13.85	21.47

[1] An explicit MOS was set at 10% of the total load.

The United States Fish and Wildlife Service indicated that there are no federally listed threatened and endangered species or designated critical habitat in the listed segments of the Shenandoah River for which this TMDL was developed.

III. Discussion of Regulatory Conditions

EPA finds that the TMDL has provided sufficient information to meet all of the requirements for establishing a PCB TMDL on the Shenandoah River. EPA's determination is outlined according to the regulatory requirements listed below.

1) The TMDL is designed to implement the applicable water quality standards.

As mentioned earlier, the Shenandoah River was listed for PCBs based on fish consumption advisories posted in both States. West Virginia has recently changed its fish consumption advisory criteria to a risk-based approach. Based on the new criteria, an advisory would be posted in West Virginia if the fish tissue concentrations of PCBs are greater than 0.0014 parts per million (ppm). The listing (in West Virginia) was based on exceedances of the Food and Drug Administration's (FDA) criteria level for PCBs of 2 ppm in fish tissue. Virginia's criterion for PCBs is 0.6 ppm in fish tissue.

The TMDL was modeled to insure that the water quality standard for PCBs would be met in both States. Virginia's water quality standard (WQS) for PCBs is 0.440 nanograms per liter (ng/L) for individual Aroclors (0.55 ng/L for total PCBs). West Virginia's WQS for total PCBs is 0.044 ng/L (total PCBs). The model was set to insure that the appropriate criteria would be met in both States. It was determined that the WQS of both States would insure compliance with the fish tissue criteria. This was done by multiplying the WQS by a bioconcentration factor value and a unit conversion.

Sediment concentrations were also incorporated into the model. Sediment was modeled as a source of additional PCBs to the water column. Similar to what was done with the WQS, observed sediment concentrations were multiplied by a biota sediment accumulation factor and a unit conversion to determine if they could cause a violation in the fish tissue. For additional information on the end points please see section 5.4.

2) The TMDL includes a total allowable load as well as individual waste load allocations and load allocations.

Total Allowable Loads

The Shenandoah PCBs TMDL includes a Total Allowable Load which is the sum of the Margin of Safety (MOS), Waste Load Allocation, and Load Allocation. The total allowable load was determined to be 214.7 g/year.

Wasteload Allocations

The only known point source of PCBs in the watershed is the waste water treatment plant (WWTP) at the Avtex Fibers Superfund site. The WWTP treats all stormwater from the site. The WWTP uses sand and bag filtration and carbon adsorption to treat PCBs in the form of microparticulates. This treatment technique is considered the best available technology for the volume of water being treated at the WWTP. A WLA of 0.200 ug/L has been set for the WWTP. The concentration was then multiplied by the year 2000 flow to derive the annual WLA of 179.38 g/yr. The concentration is lower than the detection limit of the current sampling methodology. EPA's Water Protection Division (WPD) has recommended the use of a more sensitive sampling methodology.

It should be noted that based on the current remediation plan, the WWTP should be taken off-line within the foreseeable future. This closure would eliminate the WWTP as a source of PCBs. The remediation plan will be addressing stormwater runoff through the removal and/or capping of PCB contaminated areas. Upon the completion of the remediation project, EPA does not expect the site to be a source of PCBs and has therefore assigned a Load Allocation of zero to the site. However, the WLA will be transferred to the Margin of Safety to account for any uncertainty in the loadings. For additional information on the WLA please see section 5.2.1 of the Shenandoah PCB TMDL.

Load Allocations

According to federal regulations at 40 CFR 130.2(g), load allocations are best estimates of the loading, which may range from reasonably accurate estimates to gross allotments, depending on the availability of data and appropriate techniques for predicting the loading. Wherever possible natural and nonpoint source loads should be distinguished.

The load allocation for the Shenandoah PCB TMDL contains the loading associated with all of sources of PCBs. A background loading equivalent to the PCB concentration detected at the USGS gage located upstream of the Avtex site was used to represent background conditions. The former Warren County landfill was given a load equivalent to the flow and concentration measured from a small discharge from the site. All other areas were modeled as discharging at the concentrations associated with the sampling event.

The duplicate sample taken from the North Fork of the Shenandoah was not used in the model. The sample was not used because the concentrations detected were far greater than the original sample, there were no known sources of PCBs in the area, and the concentration was significantly greater than any of the other samples taken from large flow locations. For additional information on the sampling event, please see section 4 of the Shenandoah PCB TMDL.

3) The TMDL considers the impacts of background pollutants.

As mentioned earlier, a background loading equivalent to the PCB concentration detected at the USGS gage located upstream of the Avtex site was used to represent background conditions.

4) The TMDL considers critical environmental conditions.

The TMDL was modeled using the 7Q10 flow. The 7Q10 flow represents the conditions at which point sources have the largest impact, due to the low flow and limited dilution rate of the stream. This was seen as the critical condition. Average flow conditions were used to determine the PCB loading around the Millville Dam.

5) The TMDLs consider seasonal environmental variations.

The plug-flow TMDL was run for two conditions based on the WQS and the nature of the pollutant. The TMDL was modeled based on the 7Q10 but also run using average flow conditions. The 7Q10 would be associated with dry conditions while the average flow would be the flow associated with typical year.

6) The TMDLs include a margin of safety.

An explicit Margin of Safety (MOS) has been included in the TMDL. The MOS is equal to 10% of the total load.

7) The TMDLs have been subject to public participation.

There were two public meetings held in Front Royal, Virginia to discuss the development of this TMDL. The meetings were held on February 15, 2001 and July 17, 2001. There was also a 45-day public comment period.

8) There is a reasonable assurance that the TMDL can be met.

EPA requires that there be a reasonable assurance that the TMDL can be implemented. The point source is expected to close in the foreseeable future and the PCB concentration in its effluent is currently lower than the assigned WLA. The reductions in sediment loading are expected to occur through the natural transport and burial of contaminated sediments (natural attenuation).